



**GEOLOGY IN THE VICINITY OF FRENCHMAN CAP GNEISS DOME
(82M)**

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INTRODUCTION

Regional mapping along the northwestern margin of Frenchman Cap gneiss dome has outlined a large, early synclinal structure that can be traced through the Cottonbelt area (see Höy) and projected northeastward toward the Columbia River. A number of occurrences of graded and crossbedded quartzites in both the lower and the upper limb provide reliable top determinations and allow a stratigraphic succession to be compiled. The normal succession in the lower normal limb of the syncline correlates well with the succession to the south, established by McMillan (1973) and can be projected around the northern end of Frenchman Cap dome (Fig. 7).

A re-interpretation of the Jordan River area mapped by Fyles (1970) suggests that an early Z-shaped fold dominates the structure of the area. The fold (Fig. 9) is cored by biotite schist and grey gneiss (unit 10 of Fyles) and is postulated to tectonically overlie a younger sequence of gneissic and calcareous rocks (units 4, 5, and 6). This 'younger sequence' is separated from underlying quartzites, schists, and core gneisses (units 1, 2, and 3) by the Bews Creek fault. This re-interpretation allows a revision in the 'lithologic order' suggested by Fyles (*op. cit.*). The revised succession comprises three tectonic packages: a basal quartzite sequence (units 2 and 3) above core gneisses (unit 1) overlain (with a tectonic break) by units 10 through 7 of Fyles, which in turn are overlain by gneissic, calcareous, and schistose rocks of units 6, 5, and 4. This succession is correlated with that along the north and west flank of Frenchman Cap.

NORTH AND WEST FLANK, FRENCHMAN CAP

The composite stratigraphic sequence in the Cottonbelt area (Fig. 7) is described in detail in the preceding paper (Höy, this volume) and is illustrated on Figure 8a. The base of the succession on the north limb of the syncline comprises well-layered hornblende-bearing gneisses (unit 1). These are overlain by a thick sequence of pure to feldspathic to micaceous quartzites (unit 2). These quartzites are in contact with core gneisses of Frenchman Cap dome on the south limb of the syncline. Calc-silicate gneiss, impure marble, and micaceous schist of unit 3 overlie the quartzites and are in turn overlain by schist and feldspathic gneiss of unit 4. Unit 5 comprises a heterogeneous package of dominantly calcareous rocks, including the Cottonbelt mineralization, a thin, laterally persistent carbonatite layer, a relatively pure quartzite, and a white marble. The youngest rocks in the Cottonbelt area are exposed in the core of the syncline. They consist dominantly of pelitic schist and quartzofeldspathic gneiss. A quartzite that appears in the core of the syncline in the northeastern part of the Cottonbelt area is inferred to be younger than unit 6. It has been traced northeastward by Wheeler (1963) and has tentatively been correlated with a quartzite that overlies schists and gneisses (unit 6?) and a calcareous succession (unit 5?) along the northeastern flank of Frenchman Cap (Fig. 7). These rocks will be studied in detail during the 1979 field season.

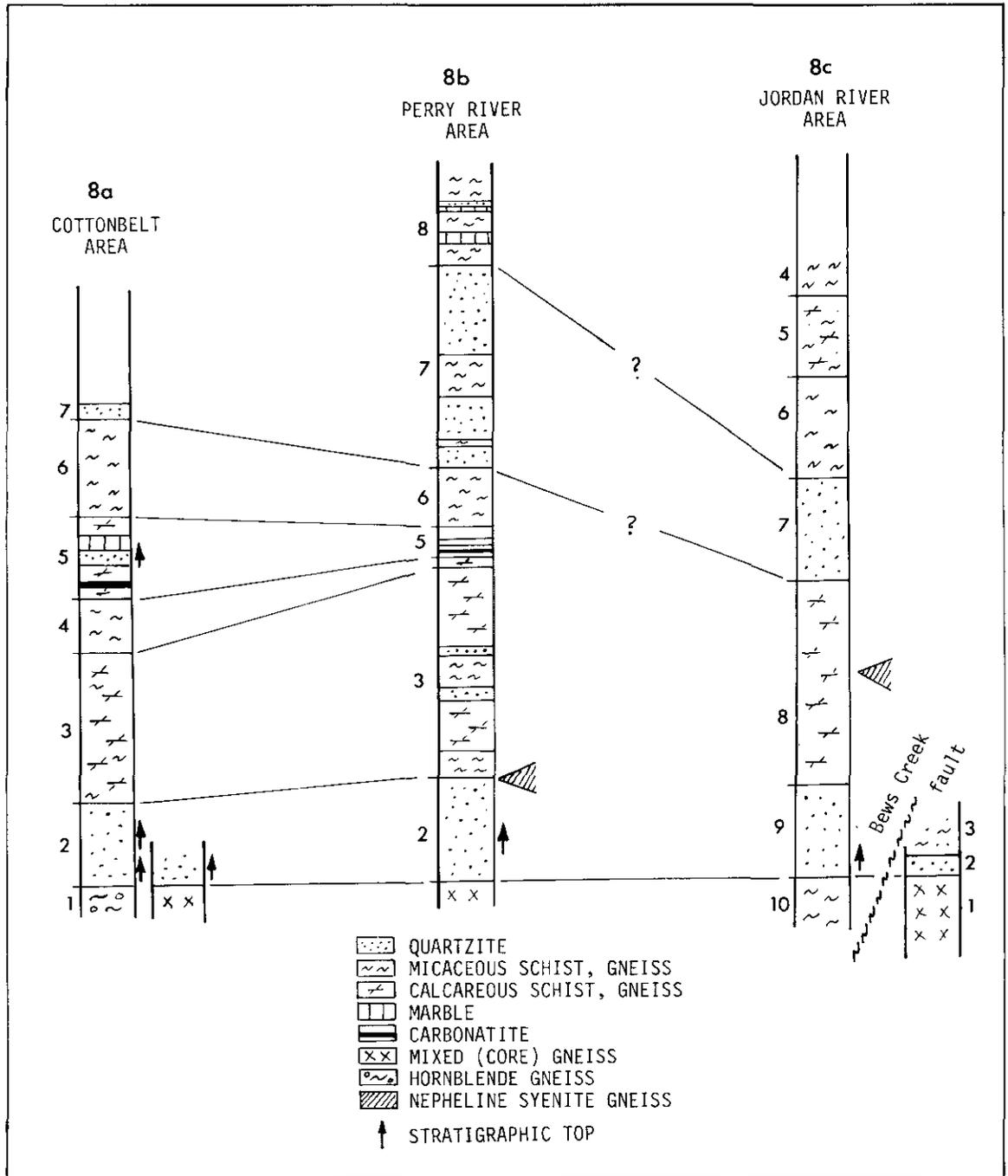


Figure 8. Stratigraphic successions in the Cottonbelt, Perry River, and Jordan River areas, and suggested correlations.

The stratigraphic succession in the Perry River area (Fig. 7), mapped by McMillan (1973), is illustrated on Figure 8b. A thick sequence of quartzites, locally crossbedded, and in part containing grit and conglomerate interbeds (unit 2), rests on core gneisses. They are overlain by calc-silicate gneiss, biotite schist, and impure marble, then a biotite schist that contains two (thin ?) quartzite beds (unit 3). These are overlain by calc-silicate gneisses and biotite schists with occasional interlayered quartzites (unit 4), a carbonatite layer and a relatively pure marble (unit 5). Kyanite-sillimanite schist (unit 6) overlies this calcareous sequence. Overlying quartzites (unit 7) contain a number of sections of feldspathic gneiss and sillimanite-bearing micaceous schist. The quartzites are overlain by a heterogeneous largely pelitic package of rocks, including kyanite and sillimanite schists, with variable amounts of calcareous schist, calc-silicate gneiss, and rare quartzite and marble beds (unit 8). A nepheline syenite gneiss is present locally between the basal quartzite (unit 2) and overlying calcareous rocks (unit 3) (McMillan, 1973).

The successions in the Perry River and Cottonbelt area are homotaxial. Of particular note is the carbonatite layer that is restricted to a single stratigraphic horizon through a strike length of at least 16 kilometres in the Cottonbelt and a similar distance in the Perry River area. It stratigraphically overlies the syenite gneiss unit. The remarkable lateral extent of a relatively thin carbonatite layer, projected and traced intermittently along a strike length of approximately 45 kilometres, supports the suggestion that it 'reached or formed at the surface' (McMillan and Moore, 1974, p. 317), probably as a pyroclastic deposit.

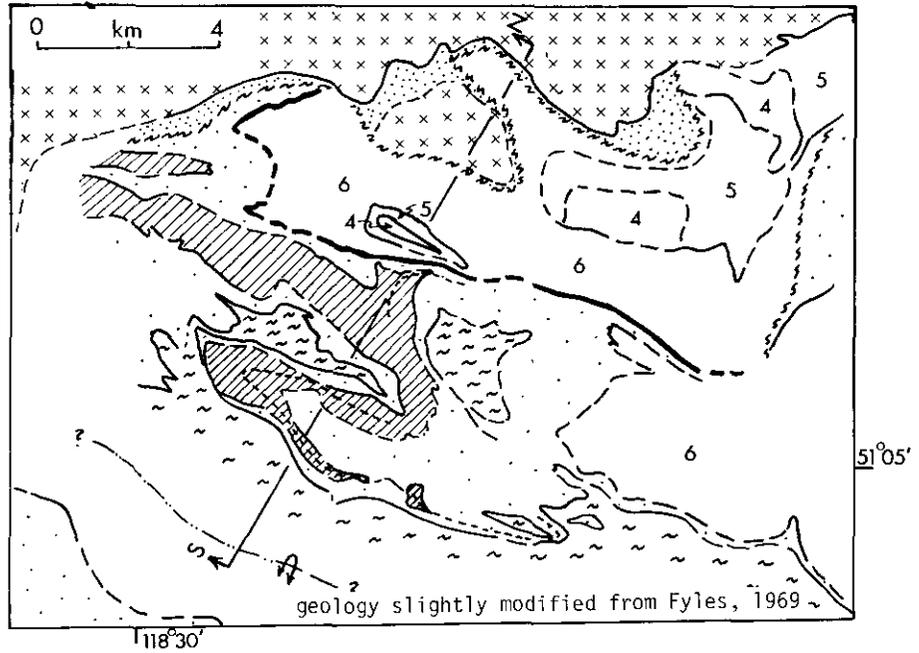
JORDAN RIVER AREA

The Jordan River area, mapped in detail by Fyles (1970), is underlain by highly deformed and metamorphosed rocks which form the southern margin of Frenchman Cap dome. Phase 1 folds there are 'isoclinal, recumbent, similar folds with warped axial planes and axes which plunge at various angles dominantly to the southwest, west, and east. Phase 2 folds are overturned with axial planes dipping southwest and south' (Fyles, 1970, p. 7).

A re-interpretation of the structure of the area, particularly of the role of phase 1 folding, resulted in a re-interpretation of the stratigraphy. However, to facilitate comparison with Fyles' map, his numerical system for stratigraphy has been conserved.

Although outcrop patterns are complex because of phase 2 folding, the structure to the south of unit 6 (Fig. 9) is dominated by an east/west-trending, recumbent Z-shaped phase 1 fold. The structurally lowest fold closure is cored by nepheline syenite gneiss and closes southward, whereas the upper fold is cored by unit 10 and closes northward. The closure of the lower fold has been mapped by Fyles in the southern part of the area. There nepheline syenite gneiss is enveloped by quartzite and calcareous schist of units 8 and 9. The upper fold closure occurs at the most northerly exposures of unit 10. In the central part of the area calcareous schists of unit 8 (and in part quartzite of unit 9) occur on the limbs of both the upper and lower fold closures of the phase 1 fold. To the west unit 9 is similarly distributed. The upper fold closure opens to the south, therefore to the south there is a large area of outcrop of the gneisses of unit 10.

The Z-shaped phase 1 fold, schematically illustrated on Figure 10, is inferred to tectonically overlie gneissic rocks of unit 6. The contact is a fault that is folded by phase 2 structures, and hence may have initiated



- | | | |
|---------------------|--|-------------------------------|
| LOWER PALEOZOIC (?) | | ✕ AXIAL TRACE OF PHASE 1 FOLD |
| ▨ | A NEPHELINE SYENITE GNEISS | ~ BEVS CREEK FAULT |
| ▧ | 4 PELITIC SCHIST | - FAULT |
| ▩ | 5 MARBLE, SCHIST, QUARTZITE | |
| ▪ | 6 GNEISS | |
| ▫ | 9,8,7 QUARTZITE, CALC. SCHIST, QUARTZITE | |
| ▬ | 10 SCHIST, GNEISS | |
| ▭ | 2,3 QUARTZITE, SCHIST | |
| PRECAMBRIAN | | |
| ✕✕ | CORE GNEISS | |

Figure 9. Geology of the Jordan River area (after Fyles, 1969).

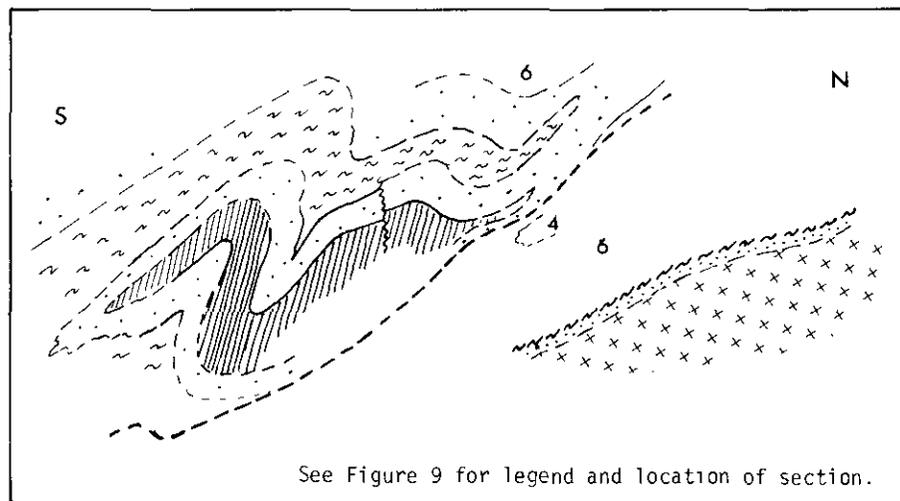


Figure 10. Schematic vertical section in the Jordan River area.

during development of the phase 1 structure. In the eastern part of the area the fault is inferred to be entirely in unit 6. Minor phase 1 fold closures south of the fault involve units 6 and 7, implying that there is no loss of stratigraphy between these units.

The lower panel (units 4, 5, and 6) is separated from core gneiss, quartzite, and schist (units 1, 2, and 3) by the Bews Creek fault.

Crossbedding in quartzite (unit 2) in the lowest structural panel indicates that it is right-way-up. It is believed to be the oldest because it contacts core gneiss. Because units 6 and 7 are folded together in the nose of a phase 1 fold just west of Jordan River there appears to be no major stratigraphic break between units 4 through 10. It is suggested that unit 10 is the oldest. It cores the larger northward-closing fold and allows a normal stratigraphic panel, the upper limb, to be exposed south of the map-area. The interpreted stratigraphic succession for the Jordan River area is illustrated on Figure 8c.

DISCUSSION

The interpreted stratigraphic succession in Jordan River area (Fig. 8C) has a number of important regional implications. Three major quartzites are represented, separated by mica schist and gneiss, calcareous schists, and marbles. It is possible that the Bews Creek fault repeats the lower part of the sequence, and that the two lower quartzites (units 2 and 9) are equivalent. The oldest units (1 and 10 ?) are schistose and gneissic rocks lacking prominent quartzites or calcareous rocks. A lead-zinc sulphide layer and associated calcareous rocks (unit 5) occur near the top of the succession above the prominent quartzites.

Correlation of this succession with sequences to the northwest is, in part, tenuous. The basal quartzite and overlying schist and quartzite (units 2 and 3) are similar lithologically to the basal quartzite on the west flank of Frenchman Cap. Both contain crossbedded quartzites and grit layers, and both overlie core gneisses. Unit 10 (Jordan River) may correlate with unit 1 in the Cottonbelt area, and the overlying quartzite-calcareous package-quartzite succession is common to both areas. The youngest (?) rocks in the Jordan River area, units 6, 5, and 4, are only partially represented at the top of the succession in the Perry River area.

These correlations imply that the nepheline syenites are at approximately the same stratigraphic positions in both the Jordan River and Perry River areas. The carbonatite therefore occurs higher in the succession than the nepheline syenite gneisses, not below as proposed by Currie (1976). Currie's argument against a pyroclastic origin for the carbonatite is therefore invalid.

The age of these rocks is unknown. Core gneisses are probably Precambrian, based on recent whole rock rubidium/strontium dates of approximately 3 Ga from core gneisses in the Thor-Odin gneiss dome (Duncan, 1978). The overlying metasedimentary rocks, with the exclusion of unit 10 which may correlate with Precambrian rocks, appear to be an outer shelf succession. We believe that they may represent a western, more calcareous and pelitic equivalent of Lower Paleozoic shelf sediments exposed in the Selkirk Mountains to the east. We do not believe that they are equivalents of the Hadrynian Horsethief Creek Group or Helikian Belt Purcell Group. We recognize that there is a considerable thickness of these older rocks missing

in the vicinity of Frenchman Cap gneiss dome. Either these were not deposited because the location of the present dome was controlled by a topographic high in Late Precambrian time, or the gneissic core rose diapirically through these rocks. This interpretation requires a major unconformity or tectonic break between the core gneisses and the mantling gneisses of Frenchman Cap gneiss dome.

ACKNOWLEDGMENTS

Discussions with Dr. James T. Fyles of the British Columbia Ministry of Mines and Petroleum Resources helped clarify some problems we had in interpreting the geology of the Jordan River area. Discussions of different aspects of the paper with D. E. Pearson and V. A. Preto, also of the Ministry of Mines and Petroleum Resources, were most helpful. The support and cooperation of Metallgesellschaft Ltd. while mapping the Cottonbelt area is gratefully acknowledged. Discussion with Bruce Mawer of Cominco Ltd. on the interpretation of the geology of the northern and northeastern margin of Frenchman Cap gneiss dome proved most informative and useful.

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